*Transactions of the Royal Society of S. Aust.* (2005), **129**(1), 81-83.

BRIEF COMMUNICATION

# HELMINTH AND PROTOZOAN PARASITES OF FERAL CATS FROM KANGAROO ISLAND

There are limited data on the helminth and protozoan parasites of the feral cat, *Felis catus*, on Kangaroo Island although the carnivore is well established there. Five helminth species from feral cats were reported in a list compiled from parasites that had been submitted to a veterinary laboratory in South Australia[1]. Surveys of the helminth species in feral cats conducted elsewhere have identified a varying prevalence dependent on the available food sources and climate[2,3,4,5,6,7]. Few of these surveys, however, identified the protozoan parasites. A significantly greater prevalence of the protozoan parasite, *Toxoplasma gondii*, has been identified in sheep on Kangaroo Island and attributed to an apparent presence of large numbers of feral cats[8]. In this study, we present data on the occurrence of the helminth and protozoan parasites detected in a sample of feral cats from Kangaroo Island.

The gastro-intestinal tract, heart, lungs, whole blood and faeces from 46 cats were submitted for examination. Organs were opened, washed and the parasites removed and counted using a dissecting microscope. The stomach wall was examined for nodules. Mucus from the stomach wall was examined specifically for *Ollulanus tricuspis* using a squash preparation on a glass slide and a compound microscope. The stomach and small intestinal wall was scraped, fixed in formalin and examined for helminths. A faecal sample was examined for helminth eggs, nematode larvae and protozoan cysts using a centrifugal flotation method in saturated $MgSO_4$ solution and additionally in saturated KI solution to determine the presence of *Cryptosporidium* oocysts[9]. The Baermann method[10] was used to recover *Aelurostrongylus abstrusus* larvae from faeces and lung parenchyma. Faecal samples were stored in 2% $K_2Cr_2O_7$ so that coccidia could sporulate for identification. Nematodes were preserved in alcohol, cleared in lactophenol and identified using a compound microscope. Armed scoleces of preserved *Taenia* specimens were removed, mounted and cleared in DeFauré's medium for the examination of rostellar hooks. Identification of *Taenia* specimens was made by counting and measuring the large and small rostellar hooks and

TABLE 1. *Helminth and protozoan parasites found in 46 feral cats from Kangaroo Island.*

| Parasite | Site | Prevalence (%) | Abundance (mean) |
|---|---|---|---|
| Acanthocephala | | | |
| *Oncicola pomatostomi* | Intestine | 7 | 2-7 (4) |
| Nematoda | | | |
| *Aelurostrongylus abstrusus* | Lung | 11 | - |
| *Ancylostoma tubaeforme* | Intestine | 15 | 1-16 (4) |
| *Cyathospirura dasyuridis* | Stomach | 15 | 1-78 (98) |
| *Cylicospirura felineus* | Stomach | 57 | 1-39 (7) |
| *Ollulanus tricuspis* | Stomach | 2 | 6 |
| *Toxocara cati* | Intestine | 76 | 1-53 (9) |
| Cestoda | | | |
| *Dipylidium caninum* | Intestine | 4 | 25-31 (28) |
| *Spirometra erinacei* | Intestine | 39 | 1-26 (5) |
| *Taenia taeniaeformis* | Intestine | 63 | 1-31 (5) |
| Trematoda | | | |
| *Brachylaima cribbi* | Intestine | 2 | 1 |
| Protozoa | Faeces | | |
| *Cryptosporidium* | | 7 | |
| *Giardia* | | 2 | |
| *Isospora felis* | | 15 | |
| *Isospora rivolta* | | 4 | |
| *Sarcocystis* | | 7 | |
| *Toxoplasma* (serology) | | IHAT 87 | |
| | | DA 89 | |

TABLE 2. *Comparison between the detection of* helminths *in the intestine and the detection of eggs in faecal samples.*

| Helminth | Intestine<br>Number infected | Faeces<br>Positive for eggs |
|---|---|---|
| *Ancylostoma tubaeforme* | 7 | 3 |
| *Brachylaima cribbi* | 1 | 1 |
| *Cyathospirura dasyuridis* & *Cylicospirura felineus* | 26 | 4 |
| *Oncicola pomatostomi* | 3 | 0 |
| *Spirometra erinacei* | 18 | 14 |
| *Toxocara cati* | 35 | 28 |
| *Taenia taeniaeformis* | 29 | 13 |

comparing the data with those of Verster[11]. An indirect haemagglutination test (Toxo HAI commercial test kit [Fumouze]) and a direct agglutination test (Antigene Toxo-AD commercial test kit [bioMérieux]) were used for detecting *Toxoplasma* antibody in serum samples from 47 cats. A dilution of 1:80 was regarded as positive for the HAI test and 1:4 for the DA test following the manufacturers instructions.

All of the cats examined were mature; six were regarded as young adults. Twenty-one cats were female and 25 male. Ten of the female cats were pregnant and two were in lactation.

The majority of the parasites found (Table 1) have been reported previously in surveys of feral cats. This study confirms that *Taenia taeniaeformis*, *Spirometra erinacei* and *Toxocara cati* are common parasites of feral cats. *Ancylostoma tubaeforme* is regarded as the common hookworm of cats and has been reported in feral cats from the Northern Territory[7] and from around Sydney[3]. *Cylicospirura felineus* and *Cyathospirura dasyuridis* were found in tumour-like nodules on the stomach wall. *Cylicospirura felineus* was the predominant species and occurred together with *Cyathospirura dasyuridis* in seven cats. The trematode, *Brachylaima cribbi*, occurs in a variety of mammals and birds, has helicid snails as intermediate hosts and is infectious to man[12]. *Oncicola pomatostomi* was detected in 65% of 188 feral cats from the Northern Territory suggesting that birds, as paratenic hosts, constituted a significant part of their diet[7]. In this study, the parasite was less common, however there is no information on the abundance of this parasite in birds from Kangaroo Island preventing further inference. The prevalence of *Isospora felis* was higher than that reported in feral cats elsewhere. Infections by *Isospora* spp. are considered age dependent, occurring more commonly in younger animals[4,5]. Whilst *Giardia* sp. was found in a faecal sample from only one cat in this study, higher prevalence reported elsewhere[13] has implicated the feral cat in the transmission of the parasite to wildlife and man. It has been suggested that *Cryptosporidium* sp. recovered from domestic cats is not of zoonotic significance and the oocysts are smaller than those recovered from man[14]. Furthermore, cats appear to carry different species such as *C. baileyi* and *C. muris*[15] essentially from birds and rodents respectively. We were unable to determine the identity of the species detected in this study. McGlade *et al.*[15] reported a significantly greater prevalence of *Cryptosporidium* sp. and *Giardia* sp. in cats using PCR in comparison to microscopy and consequently the prevalence of these two parasites may be underestimated here. The dimensions of *Sarcocystis* sp. sporocysts here are consistent with those of *S. gigantea* ($\bar{x}$ length 13.2 µm x $\bar{x}$ width 9.4 µm, n = 22), a species infecting sheep. Faecal examination may also underestimate the prevalence of toxoplasmosis. The shedding of *Toxoplasma gondii* oocysts in faeces occurs for a short time and only once following infection, usually when the young cat begins hunting rodents and birds[16]. Serological tests indicate previous exposure to the parasite. The high prevalence of *Toxoplasma* antibodies in feral cats is consistent with the high prevalence of antibodies in sheep on Kangaroo Island.

There was a poor correlation between the detection of adult nematodes and the detection of nematode eggs in faecal samples (Table 2). *Toxocara cati* eggs were not detected in faecal samples on seven occasions, six being due to infections with immature nematodes. Hookworm eggs were detected in the faeces of three of the seven cats infected. Of the four negative samples, three contained a single worm and the fourth contained three, non-gravid female worms. The detection of cestode and acanthocephalan eggs in faeces of cats infected with adult worms was similarly inconsistent. Infections of up to 31 cestodes remained undetected by faecal examination. These results indicate that coprological surveys for helminth parasites may underestimate the prevalence of infections. *Aelurostrongylus abstrusus* are small worms, <10 mm long, occurring in lung parenchyma. Adults were not recovered from lungs when examined macroscopically, however, using the Baermann technique, *Aelurostrongylus* larvae were recovered from lung tissue and faecal samples of positive cats.

The information presented in this study identified similar helminth and protozoan parasites in feral cats from Kangaroo Island to those detected elsewhere in Australia and confirms that feral cats may act as reservoirs for these parasites. The study suggests that the feral cat is responsible for the high prevalence of *Toxoplasma* in sheep on Kangaroo Island and poses a potential disease risk to wildlife. It also establishes that feral cats in Australia are infected with *Cryptosoporidium*.

[1]**O'Callaghan, M. G., Moore, E. & Ford, G. E.** (1984) Helminth and arthropod parasites from dogs and cats in South Australia. *Aust. vet. Practit.* **14**, 159-161.

[2]**Coman, B. J.** (1972) A survey of the gastro-intestinal parasites of the feral cat in Victoria. *Aust. vet. J.* **48**, 133-136.

[3]**Ryan, G. E.** (1976) Gastro-intestinal parasites of feral cats in New South Wales. *Aust. vet. J.* **52**, 224-227.
[4]**Gregory, G.G. & Munday, B. L.** (1976) Internal parasites of feral cats from the Tasmanian midlands and King Island. *Aust. vet. J.* **52**, 317-320.
[5]**Coman, B. J., Jones, E. H. & Driesen, M. A.** (1981) Helminth parasites and arthropods of feral cats. *Aust. vet. J.* **57**, 324-327.
[6]**Coman, B. J., Jones, E. H. & Westbury, H. A.** (1981) Protozoan and viral infections of feral cats. *Aust. vet. J.* **57**, 319-323.
[7]**O'Callaghan, M. G. & Beveridge, I.** (1996) Gastro-intestinal parasites of feral cats in the Northern Territory. *Trans. R. Soc. S. Aust.* **129**, 175-176.
[8]**O'Donoghue, P. J., Riley, M. J. & Clarke, J. F.** (1987) Serological survey for *Toxoplasma* infections in sheep. *Aust. vet. J.* **64**, 40-45.
[9]**O'Donoghue, P. J.** (1995) *Cryptosporidium* and cryptosporidiosis in man and animals. *Int. J. Parasitol.* **25**, 139-195.
[10]**Georgi, J. R.** (1974) Parasitology for Veterinarians (W. B. Saunders, Philadelphia. USA.) pp 134-135.
[11]**Verster, A.** (1969) A taxonomic revision of the genus *Taenia* Linnaeus, 1758 *s. str. Onderstepoort J. vet. Res.* **36**, 3-58.
[12]**Butcher, A. R. & Grove, D. I.** (2001) Description of the life-cycle stages of *Brachylaima cribbi* n. sp. (Digenea: Brachylaimidae) derived from eggs recovered from human faeces in Australia. *Sys. Parasitol.* **49**, 211-221.
[13]**Milstein, T. C. & Goldsmith, J. M.** (1997) Parasites of feral cats from southern Tasmania and their potential significance. *Aust. vet. J.* **75**, 218-219.
[14]**Sargent, K. D., Morgan, U. M., Elliot, A. & Thompson, R. C. A.** (1998) Morphological and genetic characterisation of *Cryptosporidium* oocysts from domestic cats. *Vet. Parasitol.* **77**, 221-227.
[15]**McGlade, T. R., Robertson, I. D. Elliot, A. D., Read, C. & Thompson, R. C. A.** (2003) Gastro-intestinal parasites of domestic cats in Perth, Western Australia. *Vet. Parasitol.* **117**, 251-262.
[16]**Dubey, J. P. & Beattie, C. P.** (1988) Toxoplasmosis of animals and man. (CRC Press Boca Raton, Florida. USA) pp 18-19.

M. O'CALLAGHAN, South Australian Research and Development Institute, GPO Box 397, Adelaide, SA 5001, E-mail: ocallaghan.micko@saugov.sa.gov.au, J. REDDIN, Primary Industries and Resources, PO Box 469 Murray Bridge, SA 5253 and D. LEHMANN, Kangaroo Island Veterinary Clinic, Kingscote, SA 5223.